## REMARKS

Reconsideration is requested in view of the above amendments and the following remarks. Claim 13 has been amended to include features of claims 18 and 20 and some features of claim 21, with additional revisions supported by, e.g., lines 32-34 on page 6, and lines 12-17 on page 13 of the specification. Accordingly, clams 18 and 20 have been canceled without prejudice or disclaimer and claim 21 has been amended. Claim 19 has been amended to dependent from claim 13. Claims 1-12 and 26-30 have been withdrawn from consideration.

Claims 1-16, 19, 21 and 23-30 are pending in the application.

Claims 13, 14, 18, 21 and 23 are rejected as anticipated by or, in the alternative, under 35 USC 103(a) as obvious over Iwamura II (Re. Adv. Mater. Sci. 5 (2003) 166-170) as evidenced by or in view of Iwamura III (Ceramic Transactions – Ceramic Nanomaterials And Nanotechnology II, Proceedings of the Symposium held at the 105th Annual Meeting of The American Ceramic Society, 27-30 April, 2003, Nashville, TN, US, pages 139-146).

The rejection is rendered moot since independent claim 13 has been amended to include the features of claim 20, which is not subjected to this rejection. Claims 14, 21 and 23 ultimately depend from claim 13. Applicant does not concede the correctness of the rejection.

Claims 13-16, 18-21, 23 and 24 are rejected under 35 USC 103(a) as unpatentable over U.S. Patent Application Publication No. 2002/0061397 to Iwamura I as evidenced by the present specification. Applicant respectfully traverses the rejection.

Independent claim 13 is directed to a process for producing a carbon-based thin film. The process includes (i) forming an amorphous carbon-based thin film that includes columnar first phases extending in a film thickness direction, and a second phase intervening between the first phases so that an amount of a graphite structure per unit volume in the second phase is smaller than that in the first phases and so that a density of the second phase is lower than that of the first phases, and after forming the amorphous carbon-based thin film, and (ii) after step (i), forming a graphite structure at least in the second phase by supplying energy to the amorphous carbon-

based thin film so that the amount of the graphite structure per unit volume in the second phase is larger than that in the first phases, so that the density of the second phase is higher than that of the first phases and so that in the second phase, a basal plane of the graphite structure is oriented along the film thickness direction.

The process of claim 13 includes two separate, sequential steps where according to the irradiation of the electron beam at step (ii), the densities of the first phases and the second phase are reversed, which creates two phases having different properties. In addition, since the basal plane of the graphite structure in the second phase is oriented along the film thickness direction, the second phase exhibits superior conductivity. See lines 9-10 on page 5 of the specification.

Iwamura I fails to disclose or suggest the process of claim 13. Instead, Iwamura I discloses a method for producing an onion-like carbon thin film by magnetron sputtering. As admitted in the rejection, Iwamura does not disclose or suggest forming an amorphous carbon-based thin film that includes columnar first phases and a second phase, as recited in claim 13. Actually, Fig. 6 of Iwamura I shows a microscopic image of the onion-like carbon thin film where onion-like carbon clusters are formed in a matrix (see [0054]), which is entirely different from the microstructure of the carbon-based thin film of claim 13.

In addition, claim 13 requires that a basal plane of the graphite structure be oriented along the film thickness direction. In contrast, the onion-like carbon film of Iwamura I contains clusters, each having a shell structure in which the C-planes are laminated in the form of concentric spheres (see [0023]). C-planes mean basal planes for a graphite structure. The onion-like carbon film of Iwamura I does not have a phase with a basal plane of the graphite structure oriented along a film thickness direction. Therefore, Iwamura I fails to disclose or suggest that a basal plane of the graphite structure is oriented along the film thickness direction, as recited in claim 13.

Moreover, Iwamura I does not disclose or suggest the two separate, sequential steps required by claim 13. i.e., step (i) forming an amorphous film and step (ii) after step (i), irradiating the amorphous film of (i) with an electron beam. In contrast, Iwamura I requires an irradiation with an electron beam during the process of growing the thin film (see [0041] and

Fig. 4), which is necessary to achieve the uniform onion-like carbon thin film specifically achieved by Iwamura I (see [0024]). Therefore, Iwamura I teaches away from the two separate, sequential steps of claim 13.

In addition, Iwamura fails to disclose that with step (i), the amount of the graphite structure per unit volume in the second phase is larger than that in the first phases, and a density of the second phase is lower than that of the first phases; and with step (ii), the amount of the graphite structure per unit volume in the second phase is larger than that in the first phases, and the density of the second phase is higher than that of the first phases, as recited in claim 13.

The rejection contends that in the process of Iwamura, the graphite will preferentially grow in the second phase and thus have a higher volumetric concentration in the second phase. The rejection also contends that it is readily apparent that during the process of Iwamura, the second phase density will start being higher than the first phase. This is incorrect.

The rejection admits that Iwamura I does not disclose or suggest forming first phases and a second phase of the onion-like carbon film. Since the film of Iwamura I does not have columnar first phases extending in a film thickness direction and a second phase intervening between the first phases, there would be no basis to grow the graphite in the second phase, not to mention any variations in the properties of the graphite grown therein and the comparison between the first phases and the second phase.

Claim 13 requires the process to generate a reversal in density between the first and second phases, i.e., with step (ii), the amount of the graphite structure per unit volume in the second phase changes to be larger than that in the first phases, and the density of the second phase changes to be higher than that of the first phases. In contrast, Iwamura I discloses that the film should be thick enough so that the film structure has a volume fraction of 50% or more of the clusters (see [0028]). Iwamura I teaches an increase of volume fraction of the clusters with increasing film thickness during the film-growth process, which is not a reversal in density between two phases co-existing in the film after two separate, sequential steps, as required by claim 13. Therefore, Iwamura fails to disclose or suggest the process of claim 13.

For at least these reasons, claim 13 is patentable over Iwamura. Claims 14-16, 18-21, and 23-24 depend ultimately from claim 13 and are patentable along with claim 13 and need not be separately distinguished at this time. Applicant does not concede the relevance of the rejection to the remaining features of the rejected claims.

Claims 13-16, 18, 19, 21, 23 and 24 alternatively are rejected under 35 USC 103(a) as unpatentable over Iwamura I, as discussed above, in view of JP2004-261632 to Iwamura.

The rejection is rendered moot since independent claim 13 has been amended to include the features of claim 20, which is not subjected to the rejection. Claims 14-16, 19, 21, 23 and 24 ultimately depend from claim 13. Applicant does not concede the correctness of the rejection.

Claims 24 and 25 are alternately rejected under 35 USC 103(a) as unpatentable over Iwamura I, as discussed above, in view of JP2004-261632 to Iwamura, as applied to claim 13, and further in view of U.S. Patent No. 6,251,522 to Tanaka et al. Applicant respectfully traverses this rejection.

For at least the same reasons above, claim 13 is patentable over Iwamura I (20020061397). Neither JP2004-261632 (Iwamura) nor Tanaka remedies the deficiencies of Iwamura (20020061397). Specifically, Iwamura and Tanaka do not disclose or suggest the process of claim 13. Claims 24 and 25 ultimately depend from claim 13 and are patentable along with claim 13 over Iwamura I (20020061397) in view of Iwamura and Tanaka et al. Applicant does not concede the relevance of the rejection to the remaining features of the rejected claims.

In view of the above, favorable reconsideration in the form of a notice of allowance is respectfully requested. Any questions regarding this communication can be directed to the undersigned attorney, Douglas P. Mueller, Reg. No. 30,300, at (612) 455-3804.

Respectfully submitted,

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